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Ethnozoology: A Brief Introduction

Rômulo Romeu Nóbrega Alves[1]* and Wedson Medeiros Silva Souto[2]

ABSTRACT

Connections between animals and humans date back thousands of years, and cultures all over the world have developed characteristic ways of interacting with the regional fauna over time. Human communities have accumulated a huge store of knowledge about animals through the centuries (passed from generation to generation, largely through oral traditions) that is closely integrated with many other cultural aspects, and this zoological knowledge is an important part of our human cultural heritage. The variety of interactions (both past and present) that human cultures maintain with animals is the subject matter of Ethnozoology, a discipline that has its roots as deep within the past as the first relationships between humans and other animals. Within this context, ethnozoology can be viewed as a discipline that examines the historical, economic, sociological, anthropological and environmental aspects of the relationships between humans and animals. These studies can aid in the evaluation of the impacts human populations have on native animal species and in the development of sustainable management plans - and are thus fundamental to conservation efforts. Additionally, popular knowledge about the regional fauna can be important to academic research projects and offers the possibility of significant savings in comparison to the costs involved with conventional methodologies. The present work gives a brief introduction to Ethnozoology, focusing its importance, historic aspects and current trends.

Keywords: *Animal use – Conservation – Ethnobiology*

INTRODUCTION

Extremely close connections have existed between humans and animals throughout history (Alves 2012). Humans have always attempted to understand animals, to enslave them, and to capture their strength and power (Holley 2009). Archaeological researchers have determined that humans have consumed a wide variety of fish, mollusks, birds, mammals, reptiles and amphibians for at least 1,500 years (Emery 2007; Foster and James 2002; Hamblin 1985; Kyselý 2008; Masson 1999; Masson and Peraza Lope 2008; McKillop 1984; McKillop 1985; Pohl 1976, 1981) and perhaps as many as 4,000 years (Jorgenson 1998). Other evidence of ancient human-animal relationships

1 Departamento de Biologia, Universidade Estadual da Paraíba, Av. das Baraúnas, 351/Campus Universitário, Bodocongó, 58109-753, Campina Grande, Paraíba, Brasil.

* Corresponding author – E-mail adress: romulo_nobrega@yahoo.com.br

2 Programa de Pós-Graduação em Ciências Biológicas (Zoologia), Departamento de Sistemática e Ecologia, Universidade Federal da Paraíba, 58059-970 João Pessoa, PB, Brazil, Programa de Pós-Graduação em Ciências Biológicas (Zoologia), Universidade Federal da Paraíba, João Pessoa, PB – Brasil.

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can be seen in rock paintings that depict wild animals such as bison, horses, and deer being hunted by human figures. This sort of evidence corroborates the observation of Marques (1995) that human-animal interactions have constituted a basic connection in all societies throughout history.

Hunting is one of oldest known human activities, and animals have been hunted for utilitarian reasons as well as for defense against large predators (Alves 2012). Faunal derived products are used in many ways, especially as food, but also as clothing and tools, and for medicinal and magic-religious purposes (Alvard et al. 1997; Alves et al. 2009; Alves and Pereira Filho 2007; Inskip and Zimmermann 2009; Prins et al. 2000). This enduring relationship of dependence has also contributed to the formation of affective links with certain animals, and many species were kept (and continue to be kept) as pets, especially birds and mammals and, more recently, reptiles and amphibians (Alves et al. 2010a; 2012a; Franke and Telecky 2001; Hoover 1998). These relationships with animals go beyond simple utilitarian considerations, for there have been strong supernatural relationships between the worlds of humans and animals since remote times (Alves 2012). All human cultures have mythologies, and all of them show close integration and connections with animals, and totemic, ancestral or mythological (imaginary) animals or animal-gods have been present throughout human history (Allaby 2010; Alves et al. 2012b).

The domestication of animals is an excellent example of the importance of the animals in human history. This process allowed early human societies to enrich their diets with regular sources of meat, milk and skins. Later, certain domesticated animals provided new sources of muscular energy as pack and mounted animals or for the traction of plows and wagons - thus multiplying the productive capacity of men as well as their spatial mobility (Ribeiro 1998).

As can be seen, the connections between animals and humans date back thousands of years, and cultures all over the world have developed characteristic ways of interacting with their regional fauna over time. The variety of interactions (both past and present) that human cultures maintain with animals is the subject matter of Ethnozoology, a discipline that has its roots as deep within the past as the first relationships between humans and other animals. Sax (2002) noted that human attitudes about animals evolved long before their first attempts to represent them in the arts and history, and only much later did people begin to study them scientifically. As such, the origin of ethnozoology can be thought of as coinciding with the origin of humans, with the first contacts between our species and other animals. This view of ethnozoology makes it inseparable from human culture and society.

The interrelationships between humans and animals have both positive and negative aspects. On the positive side, there are many human societies that promote a deep respect for animals, as these creatures are important actors in their spiritual traditions due to their utilitarian value. Societies in Asia, Africa and Latin America frequently established sacred localities with inherent spiritual or religious significance, and they were frequently also natural sanctuaries of biodiversity. Many traditional cultures still consider certain animal species sacred and foster their conservation (even though that is not their primary motivation) (McNeely 2001). On the other hand, animals and animal organs are universally utilized in many different manners by human groups, and anthropogenic activities can exert great direct or indirect influence on the local fauna (especially target species), and these interactions must be taken into account when conservation actions are being considered (Alves et al. 2010b,c; 2008; Alves and Albuquerque 2012). The conservation of natural resources and biodiversity is indispensable not only for preserving genetic diversity but also for guaranteeing the subsistence of large numbers of people throughout the world (Alves and Souto 2010), but it will be impossible to create meaningful animal conservation strategies without considering the effects of human uses of animals - the focus of ethnozoological studies (Alves 2012). As such, the present work gives a brief introduction to Ethnozoology, focusing its importance, historic aspects and current trends.

HISTORICAL CONSIDERATIONS

Although rock paintings and archeological inscriptions can be considered ethnozoological records (see Baker 1941), written documents have more precisely recorded information about the interactions of ancient humans groups with their regional fauna and their uses of those animals. In ancient Egypt, for example, royal hunts of wild bulls are well documented through the rein of Amenophis III during the later part of the 18th dynasty (more than 3300 B.P.) when these animals apparently became locally extinct (Dodd Jr 1993). These Old World civilizations had (often exaggerated) beliefs that certain species of animals shared important characteristics with humans, and cattle, horses and snakes, for example, became symbols that were closely associated with power/domination or libido/fertility (Dodd Jr 1993). Animals were linked to people in many ways in the cultural conceptions of the time, and contributed to defining royal institutions as well as solidifying emergent cosmologies that linked humans to celestial orbs, the earth, and the gods. These views were preserved in hieroglyphs, papyrus documents and other records left behind by ancient civilizations.

While animals and humans have shared a very long history, and although humans have been accumulating knowledge about the fauna with which they interact for untold generations, the origin of ethnozoology (like many other scientific disciplines) is linked to naturalists and explorers who spread out over the globe starting in the 16th century. As such, some of the first ethnozoological documents include the works of naturalists who demonstrated interest in the fauna as well as the zoological knowledge of native residents. These naturalists generally compiled lists of native animals together with their regional and scientific names and descriptions of their uses (Sillitoe 2006). Information concerning the use of animals by primitive populations in the New World have been accumulating ever since the first voyage of Columbus (Castetter 1944). This tradition continued through the 19th and 20th centuries, as exemplified by the voyage of Darwin on the HMS Beagle during which he recorded biological information about regional ecosystems, and the work of Wallace during his stay in the Malaysian Archipelago (now Indonesia). The zoological information contained in these pioneering works were likewise co-dependent on the work of Linnaeus - one of the most notable naturalists of that time (Ellen 2004). We can thus interpret these works as the roots of ethnozoology, as these European naturalists and explorers not only sought to learn about new regions of the world but also to take advantage of their natural resources by identifying the animal species found there and documenting their uses. Some pioneer ethnographers, such as Haddon and Boas, however, became more interested in studying the local communities that they encountered than their surrounding environments (Sillitoe 2006).

The interests of naturalists went well beyond simply recording the uses of the fauna by the native populations, and the direct or indirect help of these local populations was indispensable to discovering thousands of additional animal species. As was exemplified by Moreira (2002), 19th century naturalists spread out over the planet and enormously amplified the scientific knowledge of the time - and the success of their scientific expeditions were often greatly dependent on the collaboration of native or resident communities and their traditional knowledge. This traditional knowledge was systematized by the naturalists, filtered by the scientific outlook predominant at that time, and subsequently incorporated into the growing universal scientific pool. In the specific case of zoology, the aid of the local populations was critical in many ways, especially in terms of locating, collecting and naming animals, preparing and preserving the specimens, discovering "new" species, analyzing their habits and utilitarian features, domesticating certain "wild" animals, and in developing techniques and tools for capturing and preserving them. Moreira (2002) illustrates in a very interesting article the importance that native populations had for the natural sciences by citing the examples of three notable naturalists, the Englishmen Alfred R. Wallace (1823-1913) and Henry W. Bates (1825-1892) and the Swiss explorer Louis Agassiz (1807-1873), who all undertook expeditions to Brazil during the 19th century.

These scientists were very successful during their expeditions and made enormous contributions to zoology through their descriptions of thousands of species. Bates, for example, collected 14,712 different species (mostly insects) - of which 8,000 were new to science - during 11 years in the Amazon region. His records of his trips throughout the Amazon region cite about 135 different people (most of them by name) from all walks of life that helped during the field work and in the localization and capture of specimens: businessmen, farmers, workers, slaves, military personnel, Amerindians, and hunters. Similarly, many parts of the travel logs of Wallace in Brazil and many of the scientific articles based on these expeditions record the participation of local inhabitants in collecting specimens and mapping the Negro River. Wallace often noted in his records the importance of the native knowledge of the flora and fauna and their geographic distributions. Likewise, Louis Agassiz (who led the Thayer Expedition from 1865 to 1866) repeatedly pointed out that the contributions of the local habitants were essential to the success of the field work program by locating and capturing Amazonian fish and describing their behavior.

It can thus be seen that the histories of zoology and ethnozoology overlap - although the roles of native populations were not always been fully recognized. Moreira (2002) pointed out that although there were many diverse references in their travel logs and letters of naturalists to the essential aid provided by local habitants this information was rarely widely disseminated due to the usually concise nature of scientific publications (books, reports, articles). This situation contributed, among other factors, to the emergence of the image of scientists as "hero-explorers" that survived enormous dangers almost alone through Herculean efforts, "discovering" large numbers of new species of animals and plants. It was often emphasized that these scientists had encountered hostile relationships between indigenous groups (which probably only rarely occurred), but little note was otherwise made of the existence of these people, or that their support and knowledge had been extremely important to the success of their scientific quests.

It is important to remember that local populations continue to provide much more than simple logistic support to zoologists and ecologists (research areas that commonly count on native inhabitants) by indicating sites that are best for mounting collecting equipment (and many times even directly collecting the specimens themselves) - thus perpetuating the roles and practices that were available to early naturalists. However, even today the contributions of these native people are rarely mentioned. Silvano & Valbo-Jorgensen (2008), for example, pointed out that information derived from the ecological knowledge of local fishermen aided many later studies undertaken by biologists and ecologists although these people were rarely directly credited. These same authors suggested that ethnoecological input is often present (if only between the lines) in studies considered to be purely ecological (or zoological).

THE ORIGIN AND HISTORY OF ETHNOZOOLOGY

Ethnozoology emerged from the field of ethnosciences, and seeks to understand how the world's different people have perceived and interacted with faunal resources throughout history. The first publication with an ethnozoological orientation was that of Stearns (1889), who discussed "ethno-conchology" the study of the use of shell money (which would now be placed within the sub-area of ethnomalacology). The term ethnozoology, however, first appeared in 1899 in an article by Mason entitled *Aboriginal American Zoötechny,* considering it as a branch of Zootechnology (Mason 1899). Apparently the term ethnozoology was then essentially forgotten until the 1920s (Santos-Fita and Costa-Neto 2007). Henderson and Harrington (1914) considered Ethnozoology to be a discipline, referring to it as the study of existing cultures and their relationships with the animals in the environments surrounding them.

Others definitions of the term ethnozoology were gradually refined over time. Overal (1990) viewed ethnozoology as the study of human knowledge of the uses of animals. Marques (2002)

considered it as the transdisciplinary study of the thoughts and perceptions (knowledge and beliefs), sentiments (affective representations), and behaviors (attitudes) that intermediate the relationships between human populations and the species of animals in the surrounding ecosystems.

According to the animal taxon involved in the research, ethnozoology can be considered into sub disciplines. Different subdivisions of ethnozoology have arisen from human interactions with other important animal taxa, such as insects (Ethnoentomology), fishes (Ethnoichthyology), birds (Ethnoornithology), mammals (Ethnomastozoology), reptiles/ amphibians (Ethnoherpetology) and primates (Ethnoprimatology).

Ethnozoology is a hybrid discipline structured with combinations of elements from both the natural and social sciences. As such, researchers that develop ethnozoological research projects, whether in zoology, anthropology, ecology or other related fields, seek to complement and more closely examine the complexity of human relationships with their environments, shifting between the subjective methods of the Social Sciences and the objectivity of the Biological Sciences. As ethnozoology is part of the larger body of science of ethnobiology, the histories of the development of these two disciplines overlap. According to Clément (1998), the history of ethnobiology can be divided into three periods: pre-classical, classical and post-classical. This author noted that during the pre-classic period (which initiated in about 1860) studies were focused on collecting information about resource uses, while during the classical period (which began in 1954) a large number of linguistic studies and ethnobiological classifications (many of which had an emic perspective) were undertaken, with the growing use of methodologies taken from anthropology. We are now in a post-classical period of ethnobiology that began in 1981 (Clément 1998) and that is marked by the appearance of academic societies and specialized journals and by many researchers converging on the study of natural resource management among different ethnic groups - thus promoting an integration of ethnobiology and conservation. Additionally, the necessities of protecting and regulating access to traditional/local knowledge and sharing benefits from that knowledge with those that provided it have become recent themes in ethnobiology.

Although animals have played important roles in all human cultures since ancient times, specific studies about the uses of animals have always lagged behind similar studies devoted to plants. A pioneering work by Henderson and Harrington (1914) first used the term ethnozoology combined with ethnobotany (the latter being a much older name). Although this work did not stimulate much additional research when it was first published, a considerable body of knowledge about the utilization of animals by primitive societies could still be found in a variety of publications that were not written with a specific focus on ethnozoology (Birket-Smith 1976; Hornaday 1889; Merriam 1905; Steensby 1917).

After the publication of the first articles clearly focused on ethnozoology (Mason 1899; Stearns 1889), the subsequent development of ethnozoology within the academic sphere was frequently associated with research into ethno-scientific methods, particularly the study of *folk taxonomies* (Sturtevant 1964). Following the pre-classical tendencies of ethnobiology in 1908, Chamberlin listed the common names of animals as used by the Goshute Amerindians of the United States (Chamberlin 1908). In a later phase, ethnozoological research focused on the perception and classification of animals. Within this context, the works of Malkin concerning the ethnozoology of the Seri, Sumu, and Cora peoples in Mexico (Malkin 1956a, b, 1958) called attention to the high numbers of taxa in folk taxonomies and to native knowledge about such themes as the sexual differentiation, development, and feeding habits of local animals. Various other ethnozoological studies were undertaken during this period, revealing a grasp by traditional societies of the principals of classification, nomenclature and species identification (Berlin et al. 1973; Bright and Bright 1965; Diamond 1966).

Ethnozoologists and other researchers are currently concentrating their efforts on research areas that include: a) cultural perception and ethnozoological classification systems (Fleck et

al. 1999; Holman 2005; Mourão et al. 2006; Posey 1982); b) importance and presence of animals in stories, myths and beliefs (Descola 1998; Léo Neto et al. 2009; Lewis 1991); c) biological and cultural aspects of animal use by human societies (Dias et al. 2011; Gunnthorsdottir 2001; Posey 1978); d) methods of obtaining and preparing organic substances extracted from animals (for cosmetic, ritualistic, medicinal, or food uses, etc.) (Alves 2009; Alves and Pereira Filho 2007; Barboza et al. 2007; Costa-Neto and Oliveira 2000; Lev 2003, 2006; Rocha 2007; Rocha et al. 2008; Rosa et al. 2011; Vázquez et al. 2006); e) domestication, examining the cultural bases and the biological consequences of long-term faunal resource management (Digard 1992; Haudricourt 1977); f) biological heterogeneity and the cognitive processes involved in the management and conservation of natural resources (Alves and Nishida 2002; Fleck and Harder 2000); and g) collection techniques and their impacts on animal populations (Alves et al. 2009; Balée 1985; Bezerra et al. 2012; Nishida et al. 2006a; Nordi et al. 2009; Quijano-Hernández and Calmé 2002; Souto 2007).

THE IMPORTANCE OF ETHNOZOOLOGY

Ethnobiological studies have shown that native or local populations have a deep knowledge of nature and of the biological resources they use/interact (Alves et al. 2013a, 2010d; Alves and Rosa 2013; Begossi et al. 1999; Hanazaki et al. 2009; Maass 1999; Mourão et al. 2006; Mourão and Nordi 2002, 2006; Nishida et al. 2006a; Nishida et al. 2006b; Souto et al. 2011). This knowledge has been attracting attention throughout the world because this traditional information and these techniques have been found to complement scientific knowledge in areas such as: the evaluation of environmental impacts; resource management; and sustainable development (Johannes 1993; Posey 1984; Sillitoe 1998).

Traditional or local zoological knowledge exists in all cultures and arises from the material or spiritual relationships between humans and the regional fauna (independent of the ethnic group involved). This knowledge exists parallel to academic knowledge, but both are derived from the same source - the systematic observation of nature - although these observations are interpreted within unique cultural contexts. Both knowledge systems produce detailed empirical information about natural phenomena and the relationships between ecosystem components (Alves and Nishida 2002; Kimmerer 2002; Nishida et al. 2006b). Unfortunately, traditional knowledge has been historically pushed aside by the scientific community (Alves and Nishida 2002; Salmon 1996; Tidemann and Gosler 2010), although its importance has now come to be recognized by researchers in different areas who are intensifying research on this theme (Kimmerer 2002; Maffi et al. 1999; Tidemann and Gosler 2010).

Individuals who retain considerable local or traditional zoological knowledge tend to be people who directly use those resources (such as hunters, fishermen, harvesters/collectors) as their success at harvesting or capturing animals is intimately linked to the quality and reliability of their ecological observations (Alves et al. 2005, 2009; Alves and Nishida 2002; Begossi et al. 2008; Capistrano et al. 2012; Marques 1995; Mourão and Nordi 2003; Nordi et al. 2009; Rosa et al. 2005). As a result, these people retain a wide range of biological information than can complement traditional academic knowledge in zoology, ecology, and biological conservation studies, and could be especially useful to studies of population biology, ethnology, resource evaluation and management, patterns of climate and resource variations, interactions between species, relationships between abiotic factors and the fauna, ethnotaxonomy, and the sustainable use and adaptative administration of natural resources (Alves and Nishida 2002; Berkes 1999; Rosa et al. 2005).

The study of local or traditional zoological knowledge offers not only the possibility of new insights into biological phenomena, but also the opportunity to cross-check scientific hypotheses (Alves and Nishida 2002; Kimmerer 2002; Nishida et al. 2006b). Alves and Nishida (2002), for example, undertook an ethnozoological research program with "uçá" (*Ucides cordatus*) crab-harvesters in Brazil. The lives of these communities are

intimately linked to natural cycles - and they retain an intimate knowledge of the species they depend upon and the environment (mangrove swamps) they harvest in. Based on the folk knowledge of the crab-harvesters, these authors elaborated a hypothesis concerning the influence of tides on ecdysis (molting) in *U. cordatus*. Their results indicated that the process of ecdysis in this species in its natural environment lasts from 28 to 29 days - a period very different from that previously obtained in laboratory studies by Nascimento (1993) (who estimated that the molting process took from 15 to 20 days). These discordant results are probably attributable to the fact that it is quite difficult to simulate under laboratory conditions the tidal dynamics that are predominant characteristics in estuary environments. Thus the information furnished by the crab-harvesters provided more precise data about ecdysis than was available in the technical literature. These fishermen also furnished a good deal of information about the behavior of these crustaceans during ecdysis as well as during other important stages of their life cycle, demonstrating how local zoological knowledge can not only subsidize the formulation of scientific hypotheses, but also complement academic knowledge, furnishing precise information about certain aspects of the life cycles of animals (especially economically important groups).

Ethnozoological information has contributed to zoological research questions related to taxonomy, inventories and the geographical distributions of animals, as well as the discovery of new species. Sillitoe (2006) pointed out that the discovery of the hylid frog *Litoria bulmeri* was associated with the ethnoherpetological work of the anthropologist Ralph Bulmer (who was also honored in the naming of the new species. Zuercher et al. (2003) used molecular analyses of Cytochrome-b encountered in the feces of animals collected by Amerindians and local inhabitants in the *Reserva Natural del Bosque Mbaracayu* in Paraguay to identify carnivorous mammals in the area. These authors pointed out the importance of this local and indigenous knowledge to research projects investigating regional animals and the interactions of these species with their natural habitats. Traditional zoological knowledge has also been useful in obtaining quantitative estimates of wild animal populations. A good example of this type of project was undertaken by Anadon et al. (2010) who worked with shepherds in southeastern Spain. These authors took advantage of the traditional knowledge of these shepherds to collect data about the local abundance and populational tendencies of the terrestrial tortoise *Testudo graeca*, quantifying the reliability of the abundance estimates of the shepherds by comparing them with standard trapping techniques; they also examined the complementary nature of these two approaches. It was found that local knowledge provided high-quality and low-cost information about the distribution and abundance of *T. graeca* and estimates of tortoise abundance in an area much larger than that covered by linear transects used in their standard methodology. The abundance estimates of both methodologies were closely related and cost analyses revealed that the information obtained through local knowledge was one hundred times less costly than setting up and monitoring linear transects. The authors concluded that local knowledge could be used to complement quantitative abundance monitoring programs of a large variety of taxa, particularly when their population densities are low and traditional field sampling methods are expensive or difficult to execute.

Other examples of the importance of zoological knowledge retained by local populations have been seen in projects with fishermen, confirming that ethnoecology can provide relevant biological data more rapidly and at lower cost than traditional field research techniques (Lopes et al. 2010). A study by Silvano *et al*. (2006), for example, indicated that Brazilian fishermen had intimate knowledge of the diets and habitats of various local species of fish (some of which were barely known to conventional science). These same fishermen, however, did not have very precise information about the reproduction of some species, which may have been due to a lack of contact with these fish during their reproductive periods (especially migratory species) or to the fact that these species are usually caught before their first reproductive episode (Silvano *et al*. 2006). This sparse

knowledge of these fishermen concerning fish reproduction does not invalidate the importance of their awareness of other aspects of these fresh and salt water species, such their diet and habitat preferences (Lopes et al. 2010). Marques (1991), for example, elaborated a hypothesis (which did not initially seem very plausible) based on information provided by fishermen about an important item in the diet of an ariid catfish. The author was able, however, to confirm this hypothesis during his work and add that information to the growing body of scientific knowledge about the trophic ecology of that species.

The results of these studies and others reinforce the role of ethnozoology as an important tool to be used in undertaking faunal inventories and zoological and ecological research programs. Investigations of regional uses of animals can also contribute to a valorization of the regional fauna from an ecological point of view as well as from economic and social standpoints, and subsidize environmental management and species conservation plans that take into account the social and economic realities of the human populations that will be affected (Alves and Nishida 2003; Cullen Jr et al. 2000; Rocha-Mendes et al. 2005). A number of authors (Ainsworth et al. 2008; Gerhardinger et al. 2009; Huntington et al. 2005; Léopold et al. 2009; Mackinson and Nottestad 1998; Moller et al. 2004) have pointed out that the principal advantages of incorporating local knowledge into conservation initiatives include: collecting biological specimens, obtaining environmental information, constructing positive relationships of cooperation, and identifying common areas of interest in research projects. The latter two considerations are particularly useful during the initial development of plans directed towards recuperating species threatened with extinction (or those still poorly known). In spite of some inherent limitations, local knowledge can be an important complement to academic research because it is based on long-term observations, is almost cost-free, aids in the detection of environmental impacts, and invites the corporation and enthusiasm of local populations.

Ethnozoological studies can focus on both industrialized and non-industrialized societies, as well as traditional or non-traditional populations in rural or urban areas (Alves and Pereira Filho 2007; Marques and Guerreiro 2007). In pointing out that the study of ethnozoology "begins at home", Overal (1990) called attention to ethnozoological phenomena within our own culture (as opposed to examining culturally distant societies). This author mentions some groups and/or phenomena that could be studied from an ethnozoological perspective in both western and traditional cultures, such as: animal trainers; people that "call in" cattle, pigs, and other animals; breeders of dogs and many other pets; urban hunters; and breeders of fighting cocks and other animals kept for "sport" and betting purposes.

Public markets likewise present excellent opportunities for developing ethnozoological studies in urban areas (Alves et al. 2013b, 2010a,d; Alves and Rosa 2008; Apaza et al. 2003; Fernandes-Ferreira et al. 2012; Ferreira et al. 2013; Noss 1998; Oliveira et al. 2010; Williams et al. 2013) for many live animals (both wild and domesticated) and various products of origin animal can be found there; and these are traditional sites for exchanging and acquiring cultural information. Depending on their size, these public markets commonly have specific areas that sell animals and animal parts, and the vendors can provide important information about the different origins of those resources (Alves and Rosa 2007). Information about the exotic and native fauna of a region obtained in public markets should be very useful when evaluating conservation plans for those same natural resources (Almeida and Albuquerque 2002; Alves and Pereira Filho 2007; Alves and Rosa 2008; Alves and Santana 2008; Broad 2001; CITES 2002; Yi-Ming et al. 2000).

In spite of their cultural and economic importance, however, very few ethnozoological investigations have examined these public markets in any depth (Alves et al. 2013c). In many countries (such as Brazil) legal implications related to the commercialization of wild animals (especially those listed as threatened with extinction) contribute greatly to the difficulty of freely obtaining ethnozoological information in public places.

In many countries, especially those located in tropical regions that have great faunal diversity,

the illegal commerce in wild animals removes many species from their natural environments. This is certainly one of the gravest threats to many populations of native species, and ethnozoological studies constitute a invaluable tool for understanding the socioeconomic and cultural context into which the commercialization of the wild fauna is embedded - an essential aspect to the elaboration of conservation proposals.

As Begossi (2006) pointed out, ethnobiology is related to (and has much to contribute to) the disciplines of natural resource management and conservation biology - especially considering that all conservation strategies must deal with the question of human uses of natural resources. Similarly, Lopes et al. (2010) noted that ethnoecology studies have made many contributions to conservation efforts, including: initiating dialogs between local communities involved in or affected by conservation initiatives; suggesting better resource-use strategies (and management alternatives); monitoring the abundance of resources being used by human populations and the practical results of conservation management strategies; and a better understanding and interpretation of both general and complex ecological phenomena and environmental impacts and alterations.

FINAL CONSIDERATIONS

The connections between humans and other species of animals involve predatory and symbiotic relations established in remote times, but academic scholars have only recently begun to examine this theme with any intensity. Considering the importance of animals in contributing to the quality of life and their consequent value to society, ethnozoology can be viewed as a fundamental scientific area that examines the historical, economic, sociological, anthropological and environmental aspects of the relationships between humans and animals. These studies can aid in the evaluation of the impacts of human populations on other animal species and in the development of sustainable management plans - and are thus fundamental to conservation efforts. Additionally, popular knowledge about the regional fauna can be important to academic research projects, and it offers the possibility of significant savings in comparison to the costs involved with conventional methodologies.

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REFERENCES

1. Ainsworth CH, Pitcher TJ, Rotinsulu C (2008) **Evidence of fishery depletions and shifting cognitive baselines in Eastern Indonesia**. Biological Conservation 141:848-859.
2. Allaby M (2010) **Animals: from mythology to zoology**. Facts On File, Inc., New York.
3. Almeida CFCBR, Albuquerque UP (2002) **Uso e conservação de plantas e animais medicinais no Estado de Pernambuco (Nordeste do Brasil): Um estudo de caso**. Interciencia 27:276-285.
4. Alvard MS, Robinson JG, Redford KH, Kaplan H (1997) **The Sustainability of Subsistence Hunting in the Neotropics**. Conservation Biology 11:977-982.
5. Alves RRN, Nishida A, Hernandez M (2005) **Environmental perception of gatherers of the crab 'caranguejo-uca' (Ucides cordatus, Decapoda, Brachyura) affecting their collection attitudes**. Journal of Ethnobiology and Ethnomedicine 1(10): 1-8.
6. Alves RRN (2009) **Fauna used in popular medicine in Northeast Brazil**. Journal of Ethnobiology and Ethnomedicine 5:1-30.
7. Alves RRN (2012) **Relationships between fauna and people and the role of ethnozoology in animal conservation**. Ethnobiology and Conservation 1:1-69.
8. Alves RRN, Albuquerque UP (2012) **Ethnobiology and conservation: Why do we need a new journal?** Ethnobiology and Conservation 1:1-3.
9. Alves RRN, Leite RC, Souto WMS, Bezerra DMM, Loures-Ribeiro A (2013a) **Ethno-ornithology and conservation of wild birds in the semi-arid Caatinga of northeastern Brazil**. Journal of Ethnobiology and Ethnomedicine 9(14): 1-12
10. Alves RRN, Lima JRF, Araújo HF (2013b) **The live bird trade in Brazil and its conservation implications: an overview**. Bird Conservation International 23:53-65.
11. Alves RRN, Mendonça LET, Confessor MVA, Vieira WLS, Lopez LCS (2009) **Hunting strategies used in the semi-arid region of northeastern Brazil**. Journal of Ethnobiology and Ethnomedicine 5:1-50.
12. Alves RRN, Rosa IL, Albuquerque UP, Cunningham AB (2013c) **Medicine from the Wild: an overview of the use and trade of animal products in traditional medicines.** In: Alves, RRN and Rosa, IL (eds) Animals in Traditional Folk Medicine. Springer, Berlin, pp. 25-42.

13. Alves RRN, Nishida AK (2002) **A ecdise do caranguejo-uçá, Ucides cordatus L. (Decapoda, Brachyura) na visão dos caranguejeiros**. Interciencia 27:110-117.

14. Alves RRN, Nishida AK (2003) **Aspectos socioeconômicos e percepção ambiental dos catadores de caranguejo-uçá *Ucides cordatus cordatus* (L. 1763) (Decapoda, Brachyura) do estuário do Rio Mamanguape, Nordeste do Brasil**. Interciencia 28:36-43.

15. Alves RRN, Nogueira E, Araujo H, Brooks S (2010a) **Bird-keeping in the Caatinga, NE Brazil**. Human Ecology 38:147-156.

16. Alves RRN, Barboza RRD, Souto WMS (2010b) **A Global overview of canids used in traditional medicines.** Biodiversity and Conservation 19:1513-1522

17. Alves RRN, Souto WMS, Barboza RRD (2010c) **Primates in traditional folk medicine: a world overview.** Mammal Review 40:155 - 180

18. Alves RRN, Oliveira MGG, Barboza RRD, Lopez LCS (2010d) **An ethnozoological survey of medicinal animals commercialized in the markets of Campina Grande, NE Brazil**. Human Ecology Review 17:11-17.

19. Alves RRN, Pereira Filho GA (2007) **Commercialization and use of snakes in North and Northeastern Brazil: implications for conservation and management**. Biodiversity and Conservation 16:969–985.

20. Alves RRN, Rosa IL (2007) **Zootherapy goes to town: The use of animal-based remedies in urban areas of NE and N Brazil**. Journal of Ethnopharmacology 113:541-555.

21. Alves RRN, Rosa IL (2008) **Use of Tucuxi Dolphin Sotalia fluviatilis for Medicinal and Magic/Religious Purposes in North of Brazil**. Human Ecology 36:443–447.

22. Alves RRN, Rosa IL (2013) **Animals in Traditional Folk Medicine: Implications for Conservation**. Springer-Verlag, Berlin Heidelberg.

23. Alves RRN, Vieira KS, Santana GG, Vieira WLS, Almeida WO, Souto WMS, Montenegro PFGP, Pezzuti JCB (2012a) **A review on human attitudes towards reptiles in Brazil.** Environmental Monitoring and Assessment 184:6877-6901

24. Alves RRN, Rosa IL, Léo Neto NA, Voeks R (2012b) **Animals for the Gods: Magical and Religious Faunal Use and Trade in Brazil**. Human Ecology 40:751-780.

25. Alves RRN, Rosa IL, Santana GG (2007) **The Role of Animal-derived Remedies as Complementary Medicine in Brazil**. BioScience 57: 949-955.

26. Alves RRN, Santana GG (2008) **Use and commercialization of Podocnemis expansa (Schweiger 1812) (Testudines: Podocnemididae) for medicinal purposes in two communities in North of Brazil**. Journal of Ethnobiology and Ethnomedicine 4:6.

27. Alves RRN, Souto WMS (2010) **Etnozoologia: conceitos, considerações históricas e importância**. In: Alves RRN, Souto WMS, Mourão JS (eds) A Etnozoologia no Brasil: Importância, Status atual e Perspectivas. 1 ed. NUPEEA, Recife, PE, Brazil, pp. 19-40.

28. Alves RRN, Vieira WLS, Santana GG (2008) **Reptiles used in traditional folk medicine: conservation implications**. Biodiversity and Conservation 17:2037–2049

29. Anadón JD, Giménez A, Ballestar R (2010) **Linking local ecological knowledge and habitat modelling to predict absolute species abundance on large scales**. Biodiversity and Conservation 19:1443-1454.

30. Apaza L, Godoy R, Wilkie D, Byron E, Huanca T, Leonard WR, Peréz E, Reyes-García V, Vadez V (2003) **Markets and the use of wild animals for traditional medicine: a case study among the Tsimané ameridians of the Bolivian rain forest**. Journal of Ethnobiology 23:47-64.

31. Baker FC (1941) **A study of ethnozoology of the prehistoric Indians of Illinois**. Transactions of the American Philosophical Society 32:51-77.

32. Balée W (1985) **Ka'apor ritual hunting**. Human Ecology 13:485-510.

33. Barboza RRD, Souto WMS, Mourão JS (2007) **The use of zootherapeutics in folk veterinary medicine in the district of Cubati, Paraíba State, Brazil**. Journal of Ethnobiology and Ethnomedicine 3(32): 1-14.

34. Begossi A (2006) **Temporal stability in fishing spots: conservation and co-management in Brazilian artisanal coastal fisheries**. Ecology and Society 11:5

35. Begossi A, Clauzet M, Figueiredo JL, Guarano L, Lima R, Lopes PFM, Souza MR, Silva AL, Silvano RAM (2008) **Are biological species and high-ranking categories real? Fish folk taxonomy in the Atlantic Forest and the Amazon (Brazil)**. Current Anthropology 49:291-302.

36. Begossi A, Hanazaki N, Ramos R (2006) **Healthy fish: medicinal and recommended species in the Amazon and in the Atlantic Forest coast (Brazil)**. In: Pieroni A, Price L (eds) Eating and Healing, traditional food as medicine. 1 ed. The Haworth Press, New York, pp. 237-250.

37. Begossi A, Silvano RAM, Amaral BD, Oyakama OT (1999) **Uses of Fish and Game by Inhabitants of an Extrative Reserve (Upper Juruá, Acre, Brazil)**. Environment, Development and Sustainability 1:73-93.

38. Berkes F (1999) **Sacred Ecology: Traditional ecological knowledge and resource management**. 1 ed. Taylor & Francis, Philadelphia, USA.

39. Berlin B, Breedlove DE, Raven PH (1973) **General Principles of Classification and Nomenclature in Folk Biology**. American Anthropologist 75:214-242.

40. Bezerra DMM, Araujo HFP, Alves RRN (2012) **Captura de aves silvestres no semiárido brasileiro: técnicas cinegéticas e implicações para conservação**. Tropical Conservation Science 5:50-66.

41. Birket-Smith K (1976) **Ethnographical collections from the Northwest Passage**. AMS Press, New York.

42. Bright JO, Bright W (1965) **Semantic Structures in Northwestern California and the Sapir-Whorf Hypothesis**. American Anthropologist 67:249-258.

43. Broad S (2001) **The nature and extent of legal and illegal trade in wildlife. Hughes Hall, International and Africa Resources Trust**. TRAFFIC, Cambridge.

44. Capistrano JF, Lopes PFML (2012) **Crab gatherers perceive concrete changes in the life history traits of Ucides cordatus (Linnaeus, 1763), but overestimate their past and current catches.** Ethnobiology and Conservation 1:1-21.

45. Castetter EF (1944) **The domain of ethnobiology**. American Naturalist 78:158-170.

46. Chamberlin RV (1908) **Animal Names and Anatomical Terms of the Goshute Indians**. Proceedings of the Academy of Natural Sciences of Philadelphia 60:74-103.

47. CITES CoITiESoWFaF (2002) **AC18 Doc. 13.1 - List of species traded for medicinal purposes**. [http://www.cites.org/eng/com/ac/18/E18-13-1.pdf.].

48. Clément D (1998) **The historical foundations of ethnobiology (1860-1899)**. Journal of Ethnobiology 18:161-161.

49. Costa-Neto EM, Oliveira MVM (2000) **Cockroach is Good for Asthma: Zootherapeutic Practices in Northeastern Brazil**. Human Ecology Review 7:41-51.

50. Cullen Jr L, Bodmer RE, Padua CV (2000) **Effects of hunting in habitat fragments of the Atlantic forests, Brazil**. Biological Conservation 95:49-56.

51. Descola P (1998) **Estrutura ou sentimento: a relação com o animal na Amazônia**. Mana 4:23-45.

52. Diamond JM (1966) **Zoological Classification System of a Primitive People**. Science 151:1102-1104.

53. Dias TLP, Leo Neto NA, Alves RRN (2011) **Molluscs in the marine curio and souvenir trade in NE Brazil: species composition and implications for their conservation and management**. Biodiversity and Conservation 20:2393-2405.

54. Digard JP (1992) **Un aspect méconnu de l'histoire de l'Amérique: la domestication des animaux**. L'Homme 32:253-270.

55. Dodd Jr CK (1993) **Strategies for snake conservation**. Ecology and Behavior. McGraw-Hill, Inc., New York, pp. 363-393.

56. Ellen R (2004) **From ethno-science to science, or'What the indigenous knowledge debate tells us about how scientists define their project'**. Journal of Cognition and Culture, 4 3:409-450.

57. Emery KF (2007) **Assessing the impact of ancient Maya animal use**. Journal for Nature Conservation 15:184-195.

58. Fernandes-Ferreira H, Mendonça SV, Albano C, Ferreira FS, Alves RRN (2012) **Hunting, use and conservation of birds in Northeast Brazil**. Biodiversity and Conservation, 21 (1): 221-244.

59. Ferreira FS, Fernandes-Ferreira H, Leo Neto N, Brito SV, Alves RRN (2013) **The trade of medicinal animals in Brazil: current status and perspectives**. Biodiversity and Conservation 22:839-870.

60. Fleck DW, Harder JD (2000) **Matses Indians rainforest habitat classifi cation and mammalian diversity in Amazonian Peru**. Journal of Ethnobiology 20:1-36.

61. Fleck DW, Voss RS, Patton JL (1999) **Biological basis of saki (Pithecia) folk species recognized by the Matses Indians of Amazonian Peru**. International Journal of Primatology 20:1005-1027.

62. Foster MS, James SR (2002) **Dogs, Deer, or Guanacos: Zoomorphic Figurines from Pueblo Grande, Central Arizona**. Journal of Field Archaeology 29:165-176.

63. Franke J, Telecky TM (2001) **Reptiles as pets: an examination of the trade in live reptiles in the United States**. Humane Society of the United States, Washington (DC).

64. Gerhardinger LC, Hostim-Silva M, Medeiros RP, Matarezi J, Bertoncini Á, Freitas MO, Ferreira BP (2009) **Fishers' resource mapping and goliath grouper Epinephelus itajara (Serranidae) conservation in Brazil**. Neotropical Ichthyology 7:93-102.

65. Gunnthorsdottir A (2001) **Physical attractiveness of an animal species as a decision factor for its preservation**. Anthrozoös 14:204-215.

66. Hamblin NL (1985) **The role of marine resources in the Maya economy: a case study from Cozumel, Mexico**. Prehistoric lowland Maya environment and subsistence economy. Cambridge: Harvard university, The Peabody museum of american archaeology and ethnology, pp. 159-173.

67. Hanazaki N, Alves RRN, Begossi A (2009) **Hunting and use of terrestrial fauna used by Caicaras from the Atlantic Forest coast (Brazil)**. Journal of Ethnobiology and Ethnomedicine 5:1-36.

68. Haudricourt AG (1977) **Note d'ethnozoologie. Le rôle des excrétats dans la domestication**. L'Homme 17:125-126.

69. Henderson J, Harrington JP (1914) **Ethnozoology of the Tewa Indians**. Bulletin 56, Smithsonian Institution, Bureau of American Ethnology,

70. Holley D (2009) **The History of Modern Zoology**. [http://suite101.com/article/the-history-of-modern-zoology-a135787]

71. Holman EW (2005) **Domain-specific and general properties of folk classifications**. Journal of Ethnobiology 25:71-91.

72. Hoover C (1998) **The US role in the international live reptile trade: Amazon tree boas to Zululand dwarf chameleons**. TRAFFIC North America,

73. Hornaday WT (1889) **The extermination of the American bison, with a sketch of its discovery and life history. Annual Report 1887**.

74. Huntington HP, Suydam RS, Rosenberg DH (2005) **Traditional knowledge and satellite tracking as complementary approaches to ecological understanding**. Environmental Conservation 31:177-180.

75. Inskip C, Zimmermann A (2009) **Human-felid conflict: a review of patterns and priorities worldwide**. Oryx 43:18-34.

76. Johannes RE (1993) **Integrating traditional ecological knowledge and management with environmental impact assessment**. In: Inglis JT (ed) Traditional Ecological Knowledge: Concepts and Cases. International Program on Traditional Ecological Knowledge and International Development Research Centre, Ottawa, Canada, pp. 33–39.

77. Jorgenson JP (1998) **The impact of hunting on wildlife in the Maya Forest of Mexico**. Timber, tourists and temples: Conservation and development in the Maya forests of Belize, Guatemala and Mexico. Island Press, Washington D.C., pp. 179-194.

78. Kimmerer RW (2002) **Weaving traditional ecological knowledge into biological education: a call to action**. BioScience 52:432-438.

79. Kyselý R (2008) **Frogs as a part of the Eneolithic diet. Archaeozoological records from the Czech Republic (Kutná Hora-Denemark site, Rivnác Culture)**. Journal of Archaeological Science 35:143-157.

80. Léo Neto NA, Brooks SE, Alves RRN (2009) **From Eshu to Obatala: animals used in sacrificial rituals at Candomble "terreiros" in Brazil**. Journal of Ethnobiology and Ethnomedicine 5:1-23.

81. Léopold M, Cakacaka A, Meo S, Sikolia J, Lecchini D (2009) **Evaluation of the effectiveness of three underwater reef fish monitoring methods in Fiji**. Biodiversity and Conservation 18:3367-3382.

82. Lev E (2003) **Traditional healing with animals (zootherapy): medieval to present-day Levantine practice**. Journal of Ethnopharmacology 85:107-118.

83. Lev E (2006) **Ethno-diversity within current ethno-pharmacology as part of Israeli traditional medicine A review**. Journal of Ethnobiology and Ethnomedicine 2:1-12.

84. Lewis IM (1991) **The spider and the pangolin**. Man 26:513-525.

85. Lopes PFM, Silvano R, Begossi A (2010) **Da Biologia a Etnobiologia – Taxonomia e etnotaxomia, ecologia e etnoecologia**. In: Alves RRN, Souto WMS, Mourão JS (eds) A Etnozoologia no Brasil:

Importância, Status atual e Perspectivas. 1 ed. NUPEEA, Recife, PE, Brazil, pp. 67-94.

86. Maass P (1999) **The cultural context of biodiversity conservation**. In: Markussen M, Buse R, Garrelts H, Costa MAM, Menzel S, Marggraf R (eds) Valuation and Conservation of Biodiversity: Interdisciplinary Perspectives on the Convention on Biological Diversity 1ed. Springer, Berlim, pp. 315-342.

87. Mackinson S, Nottestad L (1998) **Points of view: combining local and scientific knowledge**. Reviews in Fish Biology and Fisheries 8:481-490.

88. Maffi L, Skutnabb-Kangas T, Andrianarivo J (1999) **Language and diversity**. In: Posey DA (ed) Cultural and Spiritual Values of Biodiversity. Intermediate Technology Publications Ltd./UNEP, London,

89. Malkin B (1956a) **Seri ethnozoology: A preliminary report**. Davidson Journal of Anthropology 2:73-83.

90. Malkin B (1956b) **Sumu ethnozoology: Herpetological knowledge**. Davidson Journal of Anthropology 2:165-180.

91. Malkin B (1958) **Cora ethnozoology, herpetological knowledge; a bioecological and cross cultural approach**. Anthropological Quarterly 31:73-90.

92. Marques JGW (1991) **Aspectos ecológicos na etnoictiologia dos pescadores do complexo estuarino-lagunar Mundaú-Manguaba, Alagoas**. Universidade Estadual de Campinas,

93. Marques JGW (1995) **Pescando pescadores: etnoecologia abrangente no baixo São Francisco alagoano**. NUPAUB-USP, São Paulo, BR.

94. Marques JGW (2002) **O Olhar (Des)Multiplicado. O Papel do Interdisciplinar e do Qualitativo na Pesquisa Etnobiológica e Etnoecológica**. In: AMOROZO MCL, MING LC, SILVA SP (eds) Métodos de Coleta e Análise de Dados em Etnobiologia, Etnoecologia e Disciplinas Correlatas. Anais do I Encontro de Etnobiologia e Etnoecologia do Sudeste. UNESP, São Paulo, SP,

95. Marques JGW, Guerreiro W (2007) **Répteis em uma Feira Nordestina (Feira de Santana, Bahia). Contextualização Progressiva e Análise Conexivo-Tipológica**. Sitientibus Série Ciências Biológicas 7:289-295.

96. Mason OT (1899) **Aboriginal American Zoötechny**. Aboriginal American Zoötechny 1:45-81.

97. Masson MA (1999) **Animal Resource Manipulation in Ritual and Domestic Contexts at Postclassic Maya Communities**. World Archaeology 31:93-120.

98. Masson MA, Peraza Lope C (2008) **Animal use at the Postclassic Maya center of Mayapán**. Quaternary International 191:170-183.

99. McKillop H (1984) **Prehistoric Maya reliance on marine resources: Analysis of a midden from Moho Cay, Belize**. Journal of Field Archaeology 11:25-35.

100. McKillop HI (1985) **Prehistoric exploitation of the manatee in the Maya and circum-Caribbean areas**. World Archaeology 16:337-353.

101. McNeely JA (2001) **Religions, traditions and biodiversity**. COMPAS Magazine, 20-22.

102. Merriam CH (1905) **The Indian Population of California**. American Anthropologist 7:594-606.

103. Moller H, Berkes F, Lyver POB, Kislalioglu M (2004) **Combining Science and Traditional Ecological Knowledge: Monitoring Populations for Co-Management**. Ecology and Society 9:

104. Moreira IC (2002) **O escravo do naturalista - O papel do conhecimento nativo nas viagens científicas do século 19**. Ciência Hoje 31:40 - 48.

105. Mourão JS, Araujo HFP, Almeida FS (2006) **Ethnotaxonomy of mastofauna as practised by hunters of the municipality of Paulista, state of Paraíba-Brazil**. Journal of Ethnobiology and Ethnomedicine 2(19): 1-7.

106. Mourão JS, Nordi N (2002) **Comparações entre as Taxonomias Folk e Científica para peixes do Estuário do Rio Mamanguape, Paraíba-Brasil**. Interciencia 27:664-668.

107. Mourão JS, Nordi N (2003) **Etnoictiologia de Pescadores Artesanais do Estuário do Rio Mamanguape, Paraíba, Brasil**. Boletim do Instituto de Pesca 29:9-17.

108. Mourão JS, Nordi N (2006) **Pescadores, peixes, espaço e tempo: uma abordagem Etnoecológica**. Interciencia 31:358-363.

109. Nascimento SA (1993) **Biologia do caranguejo-uçá Ucides cordatus**. Sergipe.

110. Nishida AK, Nordi N, Alves RRN (2006a) **Mollusc Gathering in Northeast Brazil: An Ethnoecological Approach**. Human Ecology 34:133-145.

111. Nishida AK, Nordi N, Alves RRN (2006b) **Molluscs production associated to lunar-tide cycle: a case study in Paraíba State under ethnoecology viewpoint**. Journal of Ethnobiology and Ethnomedicine 2 (28): 1-6.

112. Nordi N, Nishida AK, Alves RRN (2009) **Effectiveness of Two Gathering Techniques for Ucides cordatus in Northeast Brazil: Implications for the Sustainability of Mangrove Ecosystems**. Human Ecology 37:121-127.

113. Noss AJ (1998) **Cable snares and bushmeat markets in a central African forest**. Environmental Conservation 25:228-233

114. Oliveira ES, Torres DF, Brooks SE, Alves RRN (2010) **The medicinal animal markets in the metropolitan region of Natal City, Northeastern Brazil**. Journal of Ethnopharmacology 130:54-60.

115. Overal WL (1990) **Introduction to ethnozoology: what it is or could be**. In: Posey DA, Overal WL (eds) Ethnobiology: implications and applications. MPEG, Belém, Brasil, pp. 127-129.

116. Pohl M (1976) **Ethnozoology of the Maya: An analysis of fauna from five sites in Petén, Guatemala**. Harvard University, Boston.

117. Pohl M (1981) **Ritual continuity and transformation in Mesoamerica: Reconstructing the ancient Maya cuch ritual**. American Antiquity 46:513-529.

118. Posey DA (1978) **Ethnoentomological Survey of Amerind Groups in Lowland Latin America**. The Florida Entomologist 61:225-229.

119. Posey DA (1982) **The Importance of Bees to Kayapo Indians of the Brazilian Amazon**. The Florida Entomologist 65:452-458.

120. Posey DA (1984) **Etnoecology as applied anthropology in Amazonian development**. Hum. Organ. 43:95-107.

121. Prins HHT, Grootenhuis JG, Dolan TT (2000) **Wildlife conservation by sustainable use**. Kluwer Academic Pub,

122. Quijano-Hernández E, Calmé S (2002) **Patrones de cacería y conservación de la fauna silvestre en una comunidad Maya de Quintana Roo, México**. Etnobiología 2:1-18.

123. Ribeiro D (1998) **O processo civilizatório: etapas da evolução sociocultural**. Editora Companhia das Letras,

124. Rocha-Mendes F, Mikich SB, Bianconi GV, Pedro WA (2005) **Mamíferos do município de Fênix, Paraná: etnozoologia e conservação**. Revista Brasileira de Zoologia 22:991-1002.

125. Rocha MSP (2007) **O Uso dos recursos biológicos pelas comunidades de Barra de Mamanguape e Lagoa da Praia, no Estuário do Rio Mamanguape, litoral Norte do Estado da Paraíba: Um enfoque Etnoecológcio**. Graduação, Universidade Estadual de Paraíba, Campina Grande, PB.

126. Rocha MSP, Mourão JS, Souto WMS, Barboza RRD, Alves RRN (2008) **Uso dos recursos pesqueiros no Estuário do Rio Mamanguape, Estado da Paraíba, Brasil**. Interciencia 33:903-909.

127. Rosa IL, Alves RRN, Bonifacio K, Mourão JS, Osorio F, Oliveira TPR, Nottingham M (2005) **Fishers' knowledge and seahorse conservation in Brazil**. Journal of Ethnobiology and Ethnomedicine 1(12): 1-15.

128. Rosa IL, Oliveira TPR, Osório FM, Moraes LE, Castro ALC, Barros GML, Alves RRN (2011) **Fisheries and trade of seahorses in Brazil: historical perspective, current trends, and future directions**. Biodiversity and Conservation 20:1951-1971.

129. Salmon E (1996) **Decolonizing Our Voices**. Winds of Change 11:70-72.

130. Santos-Fita D, Costa-Neto EM (2007) **As interações entre os seres humanos e os animais: a contribuição da etnozoologia**. Biotemas 20:99-110.

131. Sax B (2002) **The Mythological Zoo: An Encyclopedia of Animals in World Myth, Legend and Literature**. ABC-CLIO, Inc., Santa Barbara,.

132. Sillitoe P (1998) **The development of indigenous knowledge**. Current Anthropology 39:223-252.

133. Sillitoe P (2006) **Ethnobiology and applied anthropology: rapprochement of the academic with the practical**. Journal of the Royal Anthropological Institute 12:S119-S142.

134. Silvano RAM, Valbo-Jørgensen J (2008) **Beyond fishermen's tales: contributions of fishers' local ecological knowledge to fish ecology and fisheries management**. Environment, Development and Sustainability 10:657-675.

135. Silvano RAM, MacCord PFL, Lima RV, Begossi A (2006) **When does this fish spawn? Fishermen's local knowledge of migration and reproduction of Brazilian coastal fishes**. Environmental Biology of fishes 76:371-386.

136. Souto FJB (2007) **Uma abordagem etnoecológica da pesca do caranguejo,** Ucides cordatus**, Linnaeus, 1763 (Decapoda: Brachyura), no manguezal do Distrito de Acupe (Santo Amaro-BA)**. Biotemas 20:69-80.

137. Souto WMS, Mourão JS, Barboza RRD, Alves RRN (2011) **Parallels between zootherapeutic practices in Ethnoveterinary and Human Complementary Medicine in NE Brazil**. Journal of Ethnopharmacology 134:753-767.

138. Stearns REC (1889) **Ethno-conchology: a study of primitive money**. Ann. Rep. US Nat. Museum for 1887, 297-334.

139. Steensby HP (1917) **An Anthropological Study of the Origin of the Eskimo Culture**. Meddelelser om Grønland, 53:39-228.

140. Sturtevant WC (1964) **Studies in Ethnoscience**. American Anthropologist 66:99-131.

141. Tidemann S, Gosler A (2010) **Ethno-ornithology: Birds, Indigenous People, Culture and Society**. 1 ed. Earthscan/James & James,

142. Vázquez PE, Méndez RM, Guiascón ÓGR, Piñera EJN (2006) **Uso medicinal de la fauna silvestre en los Altos de Chiapas, México**. Interciencia 31:491-499.

143. Williams VL, Cunningham AB, Bruyns RK, Kemp AC (2013) **Birds of a Feather: Quantitative Assessments of the Diversity and Levels of Threat to Birds Used in African Traditional Medicine**. In: Alves RRN, Rosa IL (eds) Animals in Traditional Folk Medicine: Implications for conservation. Springer, pp. 383-420.

144. Yi-Ming L, Zenxiang G, Xinhai L, Sung W, Niemelä J (2000) **Illegal wildlife trade in the Himalayan region of China**. Biodiversity and Conservation 9:901-918.

145. Zuercher GL, Gipson PS, Stewart GC (2003) **Identification of carnivore feces by local peoples and molecular analyses**. Wildlife Society Bulletin 31:961-970.

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